AF/JFW

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE
BEFORE THE BOARD OF PATENT APPEALS AND INTERFERENCES

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| In re: | Patent Application of Norman Milstein | : Group Art Unit: 1626 |
| Appln. No.: | 10/626,281 | : Examiner: Taofiq A. Solola |
| Filed: | July 24, 2003 | : Confirmation No.: 1867 |
| For: | COLOR-STABLE, LOW IMPURITY TOCOPHEROL COMPOSITIONS AND PROCESSES FOR PREPARING THE SAME | : Attorney Docket No.: **U 0113 N02B** |

Customer Number: 23657

CERTIFICATE OF MAILING

I hereby certify that this correspondence is being deposited with the U.S. Postal Service as first class mail in an envelope addressed to: Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450, on April 10, 2006.

| April 10, 2006 | Marlene Capreri | Marlene Capreri |
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## APPEAL BRIEF TRANSMITTAL

Mail Stop Appeal Brief - Patents
Commissioner for Patents
P.O. Box 1450
Alexandria, VA 222313-1450

Sir:

Appellants' brief, in triplicate, is transmitted herewith in accordance with 37 CFR 1.192.

Please charge the required fee of $500.00 to our Deposit Account No. 50-1177. This paper is enclosed in triplicate. Order No. 06-0127.

The Commissioner is hereby authorized to charge any deficiency in the required fee or to credit any overpayment to Deposit Account 50-1177.

Respectfully submitted,

Arthur G. Seifert

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**BRIEF ON APPEAL UNDER 37 C.F.R. 41.37**

Sir:

Appellants herewith appeal from the Examiner's Final Rejection dated June 8, 2005, finally rejecting claims 1-15 and 17-40, all of the claims pending in the application.

TABLE OF CONTENTS

## REAL PARTY IN INTEREST

The application on appeal is assigned to Cognis Corporation, 300 Brookside Avenue, Ambler, Pennsylvania 19002, U.S.A., which assignment was recorded in the United States Patent Office on March 24, 2004, Reel 014454, Frame 0291.

## RELATED PROCEEDINGS

Appellants are not aware of any appeals or interferences which would directly affect or would be directly affected by or have a bearing on the Boards' decision in the present appeal.

## STATUS OF CLAIMS

Claims 1-15 and 17-40 stand finally rejected. Claim 16 has been cancelled. Claims 1-15 and 17-40 are the subject of this appeal.

## STATUS OF AMENDMENTS

No amendments have been submitted subsequent to the Final Rejection.

## SUMMARY OF CLAIMED SUBJECT MATTER

The claimed invention relates to processes for the purification of tocopherol compounds, wherein a high degree of purity and color-stability are obtained. The processes according to the claimed invention provide purified tocopherols, preferably natural tocopherols, at unexpectedly high and significantly improved yields and further remove many of the unwanted components while simultaneously providing a color-stable, aesthetically-pleasing product. (See paragraph [0010] of the specification.)

Independent claim 1, as amended, is drawn to a process for producing a color-stable, low-impurity tocopherol compound or mixture of tocopherol compounds comprising: (a) providing a protecting group-substituted tocopherol compound; (b) purifying the protecting group-substituted tocopherol compound by crystallizing it from a crystallization solvent and collecting the crystallized compound; and (c) solvolyzing the purified compound

to form free tocopherol. (See the specification at paragraph [0011] at page 3, lines 20-23, and at paragraph [0019], at page 6, lines 10-11, regarding the preference for crystallization.)

In independent claim 33, in accordance with a preferred embodiment of the present invention, the protecting group-substituted tocopherol compound comprises an acetate of a natural-source tocopherol compound; the purification comprises crystallizing the acetate of the tocopherol compound from an isopropanol-containing solvent; and the solvolysis comprises reacting the purified acetate with an aqueous solution of sodium hydroxide in isopropanol under a nitrogen atmosphere at reflux conditions to form free tocopherol, in the presence of a reducing agent comprising sodium borohydride. (See the specification at paragraph [0012], at page 3, line 24 through page 4, line 2.)

Independent claim 34 is drawn to a process for purifying a tocopherol compound comprising: (a) providing a starting material comprising a tocopherol compound; (b) reacting the starting material with a protecting group to form a reaction mixture comprising a protecting group-substituted tocopherol compound; (c) separating the protecting group-substituted tocopherol compound from the reaction mixture to form a purified protecting group-substituted tocopherol compound; and (d) solvolyzing the purified compound to form a free tocopherol. (See the specification at paragraph [0013], page 4, lines 3-9.)

Independent claim 35 is drawn to a process comprising: (a) providing an ester of a tocopherol compound, (b) reacting the ester with an aqueous solution of a basic compound in an alcohol solvent under an inert atmosphere to form free tocopherol, in the presence of a reducing agent. (See the specification at paragraph [0013], at page 4, lines 10-13, and at paragraphs [0023] -[0025] on page 7.)

Independent claim 36 is drawn to a tocopherol composition comprising a natural tocopherol compound, wherein the composition has a color-stability such that the composition has a Gardner color value of less than about 6 after 24 hours at a temperature of up to about 60°C. (See the specification at paragraph [0014], at page 4, lines 14-17.)

Independent claim 37 is drawn to a composition comprising a color-stable, natural tocopherol compound, wherein the composition has an *l*-tocopherol content less than about 0.75% and a total non-*α*-tocopherol content of less than about 2%. (See the specification at paragraph [0014], at page 4, lines 17-20.)

## GROUNDS OF REJECTION TO BE REVIEWED ON APPEAL

1. Does the rejection of independent process claims 1 and 33-35 under 35 U.S.C. §112, second paragraph, for indefiniteness apply to independent composition claims 36 and 37?

2. Are independent process claims 1, and 33-35 indefinite under 35 U.S.C. §112, paragraph two, for using the functional words "providing", "purifying", "crystallizing", "solvolyzing", "collecting", "reacting", and "separating" without including in the claim specific means or conditions for carrying out these functions?

3. Is independent process claim 35 indefinite under 35 U.S.C. §112, paragraph two, because it does not specify what the "reducing agents" are?

4. Do independent claims 33, 34 and 35 separately satisfy the requirements of 35 U.S.C. §112, paragraph two?

5. Is claim 34 a duplicate of claim 1?

## ARGUMENT

### No Ground of Rejection Is Applicable to Composition Claims 36 and 37

There are no rejections of any claim over prior art under either 35 USC §102 or 35 USC §103. There are no rejections of any claim under 35 USC 112, paragraph one. There is no separate rejection of independent composition claims 36 or 37 under 35 USC §112, paragraph two, or otherwise. Appellant submits that, in the Examiner's rejection, composition claims 36 and 37 are erroneously grouped with the rejected process claims.

Since composition claims 36 and 37 do not use the functional or other allegedly indefinite wording objected to by the examiner and since they are independent claims, there is no stated ground of rejection for these two composition claims. Accordingly, Appellant respectfully solicits allowance of independent composition claims 36 and 37.

Rejection Under 35 U.S.C. §112, Second Paragraph

Claim 1 is an independent process claim, and claims 2-15 and 16-32 are directly or indirectly dependent from claim 1. Composition claim 38 is also dependent on process claim 1. Claims 33, 34 and 35 are also independent process claims. Claim 39 is dependent on claim 34, and claim 40 is dependent on claim 35.

Claims 1-15 and 17-40 are rejected as indefinite under 35 USC §112, paragraph two, as being as indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention. In the final action, the Examiner states further: "Independent claims 1, and 33-35 are written in functional language and, therefore, broader than the enabling disclosure. Therefore, claims 1-15, 17-40 are indefinite." The rejection is further stated as follows:

> "For example, claim 1 recites "providing" and ""purifying" in steps (a) and (b). The claims must recite how one how one of ordinary skill in the art would perform the "providing", "purifying" and "separating" (claim 34). The claims must recite the reagents, the reaction times, pH, and reaction conditions that are involved in the steps. Applicant may not claim all processes of "providing". "purifying" and "separating" that are applicable in the instant invention, known and yet to be developed. Applicant must claim only the processes of "providing"; "purifying" and "separating" that embody applicant's invention. If the provided compounds are starting material they should be indicated as in claim 34 step (a). The reducing agent in claim 35 is a critical element of the strep and therefore, must be identified."

The Examiner then relies on *Ex parte Fressola*, 27, USPQ 2d 1608, BdPatApp & Inter. (1993) and *In re Zletz*, 893 F2d 319, 13 USPQ2D 1320 ((Fed Cir. 1989) and unidentified sections of the MPEP as the bases for the foregoing rejection.

Note Regarding Grouping of Claims

Appellant submits that the following General Traversal against the Examiner's theory of the rejection demonstrates that the rejection under 35 USC §112, paragraph two, of the four independent process claims (1, 33, 34 and 35) and their dependent claims (2-15, 16-32 and 38-40) is untenable. Thus, all of the rejected process claims are grouped together in the General Traversal below. However, particular claims will be grouped and argued separately below with respect to the definiteness of their specific wording.

General Traversal of the Rejection of claims 1 and 33-35

The Examiner rejects independent claims 1 and 33-35 as being indefinite because they are "written in functional language and therefore broader than the enabling disclosure." Appellant respectfully traverses this rejection for the following four reasons:

(1) MPEP §2173.05(g) expressly states:
"*There is nothing inherently wrong with defining some part of an invention in functional terms. Functional language does not, in and of itself, render a claim improper.*"

(2) Process language is inherently functional.

(3) The wording of the claims comes from the disclosure and is, therefore, *of the same breadth* as the disclosure.

(4) Appellant's claims do particularly point out and distinctly claim the invention in a manner readily understood by the art-skilled person in light of the description in the specification.

(1) MPEP §2173.05(g) states that functional language should be evaluated for its definiteness - not dismissed out of hand as indefinite

> **2173.05(g) Functional Limitations**
>
> A functional limitation is an attempt to define something by what it does, rather than by what it is (e.g., as evidenced by its specific structure or specific ingredients). There is nothing inherently wrong with defining some part of an invention in functional terms. Functional language does not, in and of itself, render a claim improper. *In re Swinehart*, 439 F.2d 210, 169 USPQ 226 (CCPA 1971).
>
> "A functional limitation must be evaluated and considered, just like any other limitation of the claim, *for what it fairly conveys to a person of ordinary skill in the pertinent art* in the context in which it is used. A functional limitation is often used in association with an element, ingredient, or step of a process to define a particular capability or purpose that is served by the recited element, ingredient or step. Whether or not the functional limitation complies with **35 U.S.C. 112**, second paragraph, is a different issue from whether the limitation is properly supported under **35 U.S.C. 112**, first paragraph, or is distinguished over the prior art. A few examples are set forth below to illustrate situations where the issue of whether a functional limitation complies with **35 U.S.C. 112**, second paragraph, was considered."
>
> (Underlining and italics added.)

The Examiner here has failed to evaluate the allegedly indefinite wording of the claims for their definiteness to one skilled in the art in consideration of the disclosure of the invention. Appellant submits that the allegedly indefinite wording is indeed readily understood by the art-skilled chemist, particularly in light of the disclosure in Appellant's specification, and that such art-skilled chemist can readily practice the invention as claimed. The Examiner has provided no evidence to the contrary.

(2) Process wording is inherently functional, yet processes are specifically provided for under 35 USC §101 as useful subject matter for patents.

> "35 U.S.C. 101 Inventions patentable.

> Whoever invents or discovers any new and useful process, machine, manufacture, or composition of matter, or any new and useful improvement thereof, may obtain a patent therefor, subject to the conditions and requirements of this title."
>
> (emphasis added)

According to the Examiner's rejection, no process expressed in general terms can be patentable under 35 USC § 112, paragraph two, because it contains "functional language" which is inherently indefinite. To the contrary, the court in Federal Sign & Signal Corp. v. Bangor Punta Operations, Inc. 357 F.Supp 1222, 1222 177 USPQ 737, at 746 (S.D.N.Y. 1973) states:

> It has been clear at least since the case of *Cochrane v. Deener*, 94 U.S. 780 (1876) *that a process itself is patentable, independent of the means utilized to practice it.* Defendant seems to argue in a post-trial letter dated January 8, 1973 that the absence of alternative means of performing the methods make them somehow functional and unpatentable. But the recent relevant law is to the contrary, *Application of Traczy-Hornoch*, 397 F.2d 856 (C.C.P.A. 1968). The policy underpinnings for this position are persuasively stated in the *Traczy-Hornoch* decision, 397 F.2d at 868:
>
> > "The essential difficulty is in the fact that, although at the time of the application only one apparatus may be known which is capable of carrying out the process, others may become available later. In which case of course, the inventor may be cheated of his invention. It is peculiarly our responsibility to see that the decisional law does not require this kind of inequity."
>
> ...
>
> A process is a mode of treatment of certain materials to produce a given result. It is an act, or a series of acts, performed upon the subject-matter to be transformed and reduced to a different state or thing. If new and useful, it is just as patentable as is a piece of machinery. In the language of the patent law, it is an art. The machinery pointed out as suitable to perform the process may or may not be new or patentable; whilst the process itself may be altogether new, and produce an entirely new result. The process requires that certain things should be done with certain substances, and in a certain order; *but the tools to be used in doing this may be of secondary consequence*.
>
> (emphasis added)

In the context of the present rejection, the last italicized wording may be read "but 'how to' perform the acts may be of secondary consequence". Appellant submits that the Examiner's statements that, "under the US patent practice patentability of a process claim is determined by 'how' the process is performed" and that "the claims must recite the reagents, the reaction times, pH and reaction conditions involved in the steps", are simply incorrect.

Appellant submits that process steps, such as., "providing", "purifying", "solvolyzing", "reacting", "crystallizing" and "separating", indeed "particularly point out and distinctly claim Appellant's invention" as required under 35 USC §112, paragraph two.

(3) The wording of Appellant's claims comes from the disclosure and is, therefore, *of the same breadth* as the disclosure - i.e., it s breadth is properly supported in the specification.

Appellant's original process claim 1 is set out in the specification under the Brief Summary of the Invention on page 3, paragraph [0011]. (Original claim 1 was amended to state that purification is by crystallization.)

Appellant's original process claim 33 is indeed directed to a preferred and exemplified embodiment. The wording of this more detailed process claim is stated in the specification under the Brief Summary of the Invention on page 3, paragraph [0012]. (Only the preamble of present claim 33 has been amended from the original.)

Appellant's original process claim 34 is set out in the specification under the Brief Summary of the Invention on page 4, paragraph [0013], lines 1-9.

Appellant's original process claim 35 is set out in the specification under the Brief Summary of the Invention on page 4, paragraph [0013], lines 10-13.

The Court in In re Anderson, 471 F.2d 1237, at 1241 176 USPQ 331 (CCPA 1973), stated patentee's (Appellant's) entitlement to broad claims in addition to claims to preferred embodiments, as follows:

On the first point, the tacitly assumed need for exemplification, we do **[*1241]**

> not regard § 112, first paragraph, as requiring a specific example of everything within the scope of a broad claim. In re Gay, 50 CCPA 725, 309 F.2d 769, 135 USPQ 311 (1962). There is no question raised as to the fact that there are specific examples of what appears to be the preferred embodiment and best mode contemplated by the applicant of carrying out his claimed invention; we are here dealing only with a possible alternative embodiment within the scope of the claims. What the Patent Office is here apparently attempting is to limit all claims to the specific examples, *notwithstanding the clear disclosure of a broader invention*. This it may not do. As was stated in American Anode, Inc. v. Lee-Tex Rubber Products Corp., 136 F.2d 581, 585, 58 USPQ 7, 11 (7th Cir. 1943):
>
> ...
>
> There is no doubt that a patentee's invention may be broader than **[**9]** the particular embodiment shown in his specification. *A patentee is not only entitled to* narrow claims particularly directed to the preferred embodiment, *but also to broad claims which define the invention without a reference to specific instrumentalities*. Smith v. Snow, 294 U.S. 1 [at pages 11 et seq.]
>
> (Emphasis added)

Accordingly, Appellant submits that he is clearly entitled to the subject process claims of both the original and the present scope as their breadth is properly supported in the specification per 35 USC §112, paragraph one.

4) Appellant's claims do clearly define and distinctly claim the invention in a manner readily understood by the art-skilled person in light of the description in the specification.

Appellant submits that the particular "allegedly indefinite functional language", i.e., "providing, "purifying" "solvolyzing", "reacting", "crystallizing" and "separating", is clearly understandable to a person of skill in the chemical arts and readily conveys the substance and scope of the claim. The Examiner here has made no evaluation or presented no evidence to refute this with respect to any of the claimed terms.

The Court in Exxon Research And Engineering Company v. United States, 265

F.3d 1371, at 1375; 2001 U.S. App. LEXIS 20590; 60 U.S.P.Q.2D (BNA) 1272, [at HN1] stated for assessing the definiteness of a claim, as follows:

> Section 112 paragraph 2 of the Patent Act requires that a patent specification conclude with one or more claims "particularly pointing out and distinctly claiming subject matter which the applicant **[**7]** regards as his invention." *35 U.S.C. § 112,* P 2. We have stated the standard for assessing whether a patent claim is sufficiently definite to satisfy the statutory requirement as follows: If one skilled in the art would understand the bounds of the claim when read in light of the specification, then the claim satisfies section 112 paragraph 2. *Miles Labs., Inc. v. Shandon, Inc., 997 F.2d 870, 875, 27 U.S.P.Q.2D (BNA) 1123, 1126 (Fed. Cir. 1993).*
>
> (Underlining added.)

In the instant case, Appellant submits that the claim is indeed easy for the person skilled in the chemical arts to understand because the terms "providing", "purifying", "solvolyzing", "reacting", "crystallizing" and "separating", describe basic procedures in the chemical arts. They are also described and exemplified in more than sufficient detail in the specification.

As evidence of the level of understanding by the art-skilled chemist, Appellant has attached copies of definitions of the subject terms from Hawley's CONDENSED CHEMICAL DICTIONARY, 12th ed., Van Nostrand Reinhold Company, New York, 1993, namely, pages 253 ("chemical reaction"), 327 ("crystallization"), 977(purification"), 1029 ("separation"), and 1076 ("solvolysis"). (These copies are attached in the EVIDENCE APPENDIX. They were submitted with Appellant's Request for Reconsideration after the final action, filed October 11, 2005.)

Appellant therefore submits that the present independent process claims 1 and 33-35 do indeed satisfy the requirements of 35 USC §112, paragraph two. Appellant therefore respectfully requests that the Honorable Board of Appeals reverse the rejection of claims 1-15, 17-35 and 38-40 under 35 USC §112, paragraph two.

Neither *Ex parte Fressola* nor *In re Zletz* is relevant to the to the indefinites of Functional Language

Appellant respectfully submits that the examiner's reliance on Ex parte Fressola, Board of Appeals and Interferences, 1993 Pat. App. LEXIS 3: 27 U.S.P.Q. 2d (BNA) 1608, is misplaced. That case involved a claim 42 which read:

> "42. A system for the display of stereographic three-dimensional images of celestial objects as disclosed in the specification and drawings herein." (Underlining added.)

The present Appellant's claims do not refer to the specification, but independently, clearly claim and distinctly point out the claimed invention in wording based on that in the specification. Further, Fressola does not relate to the use of functional language and does not relate to a process claim.

Appellants respectfully submit further that the examiner's reliance on In re Zletz, CAFC, 893 F.2d 319; 1989 U.S. App. LEXIS 19432; 13 U.S.P.Q. 2d (BNA) 1320, is also misplaced. In that case, the Appellant, Dr. Zletz, lost a priority contest, but was thereafter attempting to patent the following two claims over the lost interference count.

> "13. Normally solid polypropylene having a crystalline polypropylene content.
> 14. Normally solid polypropylene"

Dr. Zletz was asserting that these claims 13 and 14 were generic to a lost count.

The claims and count in question in In re Zletz are drawn to compositions and not processes - and they do not involve functional language. There is no discussion of functional language in In re Zletz. Thus, this case does not relate to the issue in the present application.

Appellant respectfully submits further that the Examiner's reference to what the MPEP says about critical elements of a process step is not relevant here, for the

following reasons. First , the Examiner has not provided Appellant with a specific reference to the MPEP section and wording to establish its relevance. Second, the issue raised by the Examiner in this rejection is the use of functional language in a claim - which is the specific topic addressed by MPEP §2173.05(g) cited by Appellant herein. Third, the case law cited by Appellant herein is directly pertinent to evaluation of functional language (including process language) called for in MPEP §2173.05(g).

For these further reasons, Appellant submits that the rejection of claim 1-15 and 17-40 under 35 USC §112, paragraph two, is untenable and respectfully requests that the Honorable Board of Appeals reverse the Examiner.

Separate Traversal Regarding Claims 1-15 and 17-32 and Indefiniteness

Independent claim 1, as amended, is drawn to a process for producing a color-stable, low-impurity tocopherol compound or mixture of tocopherol compounds comprising: (a) providing a protecting group-substituted tocopherol compound; (b) purifying the protecting group-substituted tocopherol compound *by crystallizing it from a crystallization solvent and collecting the crystallized compound*; and (c) solvolyzing the purified compound to form free tocopherol. (See the specification at paragraph [0011] at page 3, lines 20-23, and at paragraph [0019], at page 6, lines 10-11, regarding the preference for crystallization.)

The Examiner objects to the underlined process words as being "indefinite", but does not evaluate and consider them *for what they fairly convey to a person of ordinary skill in the pertinent art* in the context in which it is used. Appellant submits that the art skilled chemist can readily understand what is encompassed by this word. Such person would readily understand that "providing" a protecting group-substituted tocopherol compound according to step (a) can be done, for example, by direct purchase or by reacting a wide variety of commercially available tocopherol compounds and with a wide variety of commercially available protective group compounds. (The art skilled person would also understand that "providing" could also begin with extracting

tocopherol compounds from a plant known to produce them by known extraction methods.) In the instant claim "purifying" in step (b) is further modified by "crystallizing" and "collecting" to which the examiner does not object. In addition to the knowledge by a person of the skill in the art, paragraphs [0019] - [0021] of the specification provide ample directions on means of carrying out purification by crystallization and collection. The art-skilled chemist would readily understand that "the term "solvolysis", used in step (c), simply refers to a reaction in which the solvent is also a reactant, which, in this case acts to cleave the ester group from the tocopherol compound. In addition to the knowledge of the person skilled in the art about such solvolysis type lyzing reactions, they are described in detail in the specification at paragraphs [0022] - [0027].

Additionally, the Examiner has provided no analysis or evidence to show that the objected to terms are not readily understood by the art skilled person.

Accordingly, Appellant submits that independent process claim 1 indeed particularly points out and distinctly claims the subject matter of the invention. Appellant therefore respectfully requests that the Honorable Board of Appeals reverse the Examiner's rejection of claims 1-15, 17-32 and 38 under 35 USC §112, paragraph two.

Separate Traversal Regarding Claim 33 and Indefiniteness

Independent claim 33 is drawn to a preferred embodiment of the process of claim 1. In independent claim 33, providing a protecting group-substituted tocopherol compound of step (a) comprises providing an acetate of a natural-source tocopherol compound; the purification of step (b) specifically comprises crystallizing the acetate of the tocopherol compound from an isopropanol-containing solvent; and the solvolysis of step (c) specifically comprises reacting the purified acetate with an aqueous solution of sodium hydroxide in isopropanol under a nitrogen atmosphere at reflux conditions to form free tocopherol, in the presence of a reducing agent comprising sodium borohydride. (See the specification at paragraph [0012], at page 3, line 24 through page 4, line 2.)

Appellant submits that the art skilled +chemist can readily understand what is encompassed by the word "providing". Such a person would readily understand that "providing" an acetate of a natural-source tocopherol compound according to step (a) can be done, for example, by direct purchase or by reacting a wide variety of commercially available natural tocopherol compounds with a wide variety of available protective group compounds. (Particularly in this case, the art skilled person would also understand that "providing" could also begin with extracting tocopherol compounds from a plant known to produce them by known extraction methods.)

With respect to step (b) of claim 33, the Examiner has not specifically objected to the term "crystallizing". Nevertheless, Appellant submits that the art skilled person can readily understand what is encompassed by this term. Additionally, this claim 33 specifies that the compound to be crystallized is an acetate of a tocopherol compound and specifically refers to a crystallization solvent which is isopropanol, making it even more distinct to the art skilled person than in step (b) of claim 1. The Examiner has also not specifically objected to the word "reacting" used in step (c) of claim 33. Nevertheless, Appellant submits that a person skilled in the art of chemistry readily understands what this word encompasses. In addition, the subject step (c) specifies the reactants, the solvent and the atmospheric and temperature reaction conditions. making it particularly distinct and understandable even to a person of lesser skill in the art.

Additionally, the Examiner has provided no analysis or evidence to show that the objected to terms are not readily understood by the art skilled person.

Accordingly, Appellant submits that independent process claim 33 indeed particularly points out and distinctly claims the subject matter of the invention. Appellant therefore respectfully requests that the Honorable Board of Appeals reverse the Examiner's rejection of claims 33 under 35 USC §112, paragraph two.

Separate Traversal Regarding Claims 34 and 39 and Indefiniteness

Independent claim 34 is drawn to a process for purifying a tocopherol compound comprising: (a) providing a starting material comprising a tocopherol compound; (b) reacting the starting material with a protecting group to form a reaction mixture comprising a protecting group-substituted tocopherol compound; (c) separating the protecting group-substituted tocopherol compound from the reaction mixture to form a purified protecting group-substituted tocopherol compound; and (d) solvolyzing the purified compound to form a free tocopherol. (See the specification at paragraph [0013], page 4, lines 3-9.)

Appellant submits that the art skilled chemist can readily understand what is encompassed by the term "providing" in step (a) of claim 34. Such person would readily understand that "providing" a tocopherol compound according to step (a) can be done, for example, by direct purchase or by reacting a wide variety of commercially available tocopherol compounds. (The art skilled person would also understand that "providing" could also begin with extracting tocopherol compounds from a plant known to produce them by known extraction methods.) The Examiner has also not specifically objected to the word "reacting" used in step (b) of claim 34. Nevertheless, Appellant submits that a person skilled in the art of chemistry readily understands what this word encompasses, particularly in the context of this claim in which "reacting" is "with a protecting group to form a reaction mixture comprising a protecting group-substituted tocopherol compound" These are well known reactions in chemistry. The art skilled chemist would also readily understand what the term "separating" in step (c) encompasses. Chemical reactions almost always need to be followed by a separation step in order to isolate and recover the desired product. Thus, numerous separation techniques are well documented in the chemical arts and readily practiced by the art skilled chemist. The art-skilled chemist would also readily understand that the term "solvolysis", used in step (d), simply refers to a reaction in which the solvent is also a reactant, which, in this case acts to cleave the ester group from the tocopherol compound. In addition to the knowledge of the person skilled in the art about such solvolysis type lyzing reactions, they are described in detail in the specification at

paragraphs [0022] - [0027].

Additionally, the Examiner has provided no analysis or evidence to show that the objected to terms are not readily understood by the art skilled person.

Accordingly, Appellant submits that independent process claim 34 indeed particularly points out and distinctly claims the subject matter of the invention. Appellant therefore respectfully requests that the Honorable Board of Appeals reverse the Examiner's rejection of claims 34 under 35 USC §112, paragraph two.

Separate Traversal Regarding Claims 35 and 40

Independent claim 35 is drawn to a process comprising: (a) providing an ester of a tocopherol compound, (b) reacting the ester with an aqueous solution of a basic compound in an alcohol solvent under an inert atmosphere to form free tocopherol, in the presence of a reducing agent. (See the specification at paragraph [0013], at page 4, lines 10-13, and at paragraphs [0023] -[0025] on page 7.)

The Examiner objects to the term "providing" as being indefinite under 35 USC §112, paragraph two. Appellant submits that the art skilled chemist can readily understand what is encompassed by "providing". Such person would readily understand that "providing" an ester of a tocopherol compound according to step (a) can be done, for example, by direct purchase or by reacting a wide variety of commercially available tocopherol compounds and with a wide variety of commercially available ester compounds. (The art skilled person would also understand that "providing" could also begin with extracting tocopherol compounds from a plant known to produce them by known extraction methods.) The Examiner has not specifically objected to the term "reacting" used in step (b) of claim 35. Nevertheless, Appellant submits that a person skilled in the art of chemistry readily understands what this term encompasses, particularly in the context wherein "reacting" is further spelled out as follows: "reacting the ester with an aqueous solution of a basic compound in an alcohol solvent under an inert atmosphere to form free tocopherol, in the presence of a reducing agent".

Additionally, the Examiner has provided no analysis or evidence to show that the objected to terms are not readily understood by the art skilled person.

Accordingly, Appellant submits that independent process claim 35 indeed particularly points out and distinctly claims the subject matter of the invention. Appellant therefore respectfully requests that the Honorable Board of Appeals reverse the Examiner's rejection of claim 35 under 35 USC §112, paragraph two.

**Rejection of claim 35 as Indefinite Regarding "Reducing Agent"**

Claim 35 is further rejected under 35 USC §112, paragraph two, as indefinite because "the "reducing agent" is a critical element of the step and therefore, must be identified." In response to Appellant's traverse, the Examiner states: "This is not persuasive because, according to the MPEP critical elements are those elements without which a process claim cannot be performed, and therefore must be disclosed." (emphasis added).

The present rejection is under 35 USC §112, paragraph two, not paragraph one. No rejection has been made under paragraph one. The Examiner provides no basis for rejecting the claim because the term "reducing agent" is not readily understood in the art. Appellant submits that the so-called "critical element", namely "reducing agent", is indeed in the rejected claim. Appellant submits further that the art skilled chemist would readily understand what the term "reducing agent" encompasses, particularly in the context of the reaction specified in this step (b) of the claim. Moreover, the Examiner has not provided the specific MPEP section upon which he is relying.

Appellant therefore respectfully requests that the Honorable Board of Appeals reverse the Examiner's rejection of claim 35 under 35 USC §112, paragraph two, with respect to the term "reducing agent".

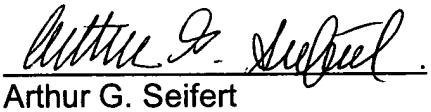
**Rejection of claim 34 as a duplicate of claim 1**

Claim 34 is further rejected under 35 USC §112, paragraph two as a substantial duplicate of claim 1. Contrary to the Examiner's assertion, Appellant submits that

claims 1 and 34 involve substantially different process steps due to the nature of the starting material, namely, a "protecting group-substituted tocopherol compound" in claim 1 and a "a tocopherol compound" in claim 34. In claim 1, the "protecting group-substituted tocopherol compound" could be, for example, a mixture or composition free from the other products of the protection reaction itself, which is thus purified (further) by crystallization in step (b). In claim 34, on the other hand, "a tocopherol compound" is reacted to form a reaction mixture comprising a protecting group-substituted tocopherol compound. This reaction mixture is then "separated" in step (c) in a manner to provide purified protecting group compound. Thus, even though the final result may be substantially the same, one process can be infringed without infringing the other. Since, Appellant is the first to disclose and claim both processes, he is entitled to protection for both.

Appellant therefore respectfully requests that the Honorable Board of Appeals reverse the Examiner's rejection of claim 34 as a duplicate of claim 1 under 35 USC §112, paragraph two.

Respectfully submitted,



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Enc.: 1. Claims Appendix
2. Evidence Appendix
3. Related Proceedings Appendix

## CLAIMS APPENDIX

### CLAIMS ON APPEAL

Claim 1 (Previously presented): A process for producing a color-stable, low-impurity tocopherol compound or mixture of tocopherol compounds comprising:
(a) providing a protecting group-substituted tocopherol compound;
(b) purifying the protecting group-substituted tocopherol compound by crystallizing it from a crystallization solvent and collecting the crystallized compound; and
(c) solvolyzing the purified compound to form free tocopherol.

Claim 2 (Original): The process according to claim 1, wherein the solvolyzing is carried out under an inert atmosphere.

Claim 3 (Original): The process according to claim 2, wherein the inert atmosphere comprises nitrogen.

Claim 4 ((Previously presented): The process according to claim 1, wherein the protecting group-substituted tocopherol compound is an ester.

Claim 5 (Original): The process according to claim 4, wherein the ester is selected from the group consisting of an acetate, a succinate, a phosphate, a phosphinate, a sulfonate and a carbonate.

Claim 6 (Previously presented): The process according to claim 4, wherein the ester is selected from the group consisting of an acetate and a succinate.

Claim 7 (Previously presented): The process according to claim 4, wherein the ester is an acetate.

Claim 8 (Original): The process according to claim 1, wherein the tocopherol compound comprises *α*-tocopherol.

Claim 9 (Original): The process according to claim 8, wherein the *α*-tocopherol is present in an amount of at least about 80% by weight based on the total tocopherol content.

Claim 10 (Original): The process according to claim 1, wherein the tocopherol compound comprises *d*-*α*-tocopherol.

Claim 11 (Original): The process according to claim 10, wherein the *d*-*α*-tocopherol is present in an amount of at least about 80% by weight based on the total tocopherol content.

Claim 12 (Previously presented): The process according to claim 1, wherein the tocopherol compound is a natural-source tocopherol.

Claim 13 (Previously presented): The process according to claim 12, wherein the protecting group-substituted tocopherol compound is an ester.

Claim 14 (Previously presented): The process according to claim 13, wherein the ester is selected from the group consisting of an acetate and a succinate.

Claim 15 (Previously presented): The process according to claim 13, wherein the ester is an acetate.

Claim 16 (Canceled)

Claim 17 (Previously presented): The process according to claim 1, wherein collecting the crystallized compound is by filtration.

Claim 18 (Previously presented): The process according to claim 1, wherein the crystallization solvent comprises a lower alcohol.

Claim 19 (Previously presented): The process according to claim 1, wherein the crystallization solvent comprises isopropanol.

Claim 20 (Previously presented): The process according to claim 1, wherein crystallizing the compound is carried out at a temperature below room temperature and above the freezing point of the crystallization solvent.

Claim 21 (Previously presented): The process according to claim 1, wherein the crystallization solvent comprises isopropanol and crystallizing the compound is carried out at a temperature of from about 10°C to about -50°C.

Claim 22 (Previously presented): The process according to claim 1, further comprising re-mixing the crystallized compound with the crystallization solvent and repeating the crystallizing and the collecting at least once in sequential order.

Claim 23 (Previously presented): The process according to claim 1, wherein the protecting group-substituted tocopherol compound is an ester, and wherein solvolyzing the ester comprises a reaction selected from the group consisting of acid-catalyzed hydrolysis and base-promoted hydrolysis.

Claim 24 (Previously presented): The process according to claim 1, wherein the protecting group-substituted tocopherol compound is an ester, and wherein solvolyzing the ester comprises base-promoted hydrolysis.

Claim 25 (Original): The process according to claim 24, wherein solvolyzing the ester comprises reacting the ester with an aqueous solution of a basic compound selected from the group consisting of alkali metal hydroxides, alkaline earth metal hydroxide, ammonium hydroxide, and metal hydrides.

Claim 26 (Original): The process according to claim 25, wherein the basic compound comprises an alkali metal hydroxide.

Claim 27 (Original): The process according to claim 25, wherein the basic compound comprises sodium hydroxide.

Claim 28 (Original): The process according to claim 24, wherein the hydrolysis is carried out in the presence of an alcohol solvent.

Claim 29 (Original): The process according to claim 28, wherein the alcohol solvent comprises isopropanol.

Claim 30 (Original): The process according to claim 24, wherein the hydrolysis is carried out in the presence of a reducing agent.

Claim 31 (Original): The process according to claim 30, wherein the reducing agent comprises sodium borohydride.

Claim 32 (Original): The process according to claim 15, wherein the hydrolysis is carried out under reflux conditions.

Claim 33 (Previously presented): A process for producing a color-stable, low-impurity tocopherol compound or mixture of tocopherol compounds, said process comprising:
(a) providing an acetate of a natural-source tocopherol compound;
(b) crystallizing the acetate of the tocopherol compound from a solvent comprising isopropanol and collecting a purified acetate of the tocopherol compound; and
(c) reacting the purified acetate with an aqueous solution of sodium hydroxide in isopropanol under a nitrogen atmosphere at reflux conditions to form free tocopherol, in the presence of a reducing agent comprising sodium borohydride.

Claim 34 (Original): A process for purifying a tocopherol, said process comprising:
(a) providing a starting material comprising a tocopherol compound;
(b) reacting the starting material with a protecting group to form a reaction mixture comprising a protecting group-substituted tocopherol compound;
(c) separating the protecting group-substituted tocopherol compound from the reaction mixture to form a purified protecting group-substituted tocopherol compound; and
(d) solvolyzing the purified compound to form a free tocopherol.

Claim 35 (Previously presented): A process for purifying a tocopherol, said process comprising:
(a) providing an ester of a tocopherol compound,
(b) reacting the ester with an aqueous solution of a basic compound in an alcohol solvent under an inert atmosphere to form free tocopherol, in the presence of a reducing agent.

Claim 36 (Original): A composition comprising a natural tocopherol compound, wherein the composition has a color-stability such that the composition has a Gardner color value of less than about 6 after 24 hours at a temperature of up to about 60°C.

Claim 37 (Original): A composition comprising a color-stable, natural tocopherol compound, wherein the composition has an *l*-tocopherol content less than about 0.75% and a total non-*α*-tocopherol content of less than about 2%.

Claim 38 (Original): A composition comprising a color-stable, natural tocopherol compound prepared by a process according to claim 1.

Claim 39 (Original): A composition comprising a color-stable, natural tocopherol compound prepared by a process according to claim 34.

Claim 40 (Original): A composition comprising a color-stable, natural tocopherol compound prepared by a process according to claim 35.

## EVIDENCE APPENDIX

Definitions of rejected terms from Hawley's CONDENSED CHEMICAL DICTIONARY, 12th ed., Van Nostrand Reinhold Company, New York, 1993, namely, pages 253 ("chemical reaction"), 327 ("crystallization"), 977(purification"), 1029 ("separation"), and 1076 ("solvolysis"). (Submitted with Appellant's Request for Reconsideration after the final action, filed October 11, 2005.)

Evidence Appendix pages E1-E7

*Hawley's*

# *Condensed Chemical*

# *Dictionary*

*TWELFTH EDITION*

*Revised by*

Richard J. Lewis, Sr.

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A comparatively recent development in the nomenclature of inorganic and complex compounds is use of the Stock system, in which Roman numerals indicate the oxidation state or coordination value. For example, iron II chloride stands for ferrous chloride ($FeCl_2$), and iron III chloride for ferric chloride ($FeCl_3$).
See also Geneva System, benzene.

**chemical oxygen demand.** (COD). Refers to the amount of oxygen, expressed in parts per million, consumed under specified conditions in the oxidation of the organic and oxidizable inorganic matter contained in an industrial waste water, corrected for the influence of chlorides.
See oxygen consumed.

**chemical planetology.** Application of various branches of chemistry (analytical, physical, and geochemistry) to study the composition of the surface and atmosphere of the planets, mainly Venus, Mars, and Jupiter. Much information has been obtained by spectrographic methods, and valuable additional data have resulted from space probes.
See also astrochemistry.

**chemical potential.** The rate at which the total free energy of a phase in a system changes as the amount of a particular component changes, keeping pressure, temperature, and amounts of all other components of the phase the same.

**chemical process industry.** An industry whose product(s) results from (1) one or more chemical or physicochemical changes; (2) extraction, separation, or purification of a natural product with or without chemical reactions; (3) the preparation of specifically formulated mixtures of materials, either natural or synthetic. Examples are as follows (with allowance for some overlapping): (1) the plastics, rubber, leather, food, dye, and synthetic organic industries; (2) the petroleum, paper, textile, and perfume industries. (3) Many of these involve one or more unit operations of chemical engineering as well as basic processes as polymerization, oxidation, reduction, hydrogenation, etc., usually with the aid of a catalyst. This definition may be interpreted to include ore processing, separation, and refinement, as well as the manufacture of metal products; however, these are usually considered to comprise the metal and metallurgical industries.

**chemical reaction.** A chemical change that may occur in several ways, e.g., by combination, by replacement, by decomposition, or by some modification of these. Reactions are endothermic when heat is needed to maintain them, and exothermic when they evolve heat. All chemical reactions are in balance, i.e., the numbers of atoms of the various elements in the reacting substances are always equal to the numbers of atoms in the reaction products. Common types of reactions are oxidation, reduction, ionization, combustion, polymerization, hydrolysis, condensation, enolization, saponification, rearrangement, etc. Chemical reactions involve rupture of only the bonds which hold the molecules together, and should not be confused with nuclear reactions where the atomic nucleus is involved. A reversible reaction is one in which the reaction product is unstable and thus changes back into the original substance spontaneously. In a complete reaction, the activity goes to completion and is indicated by an arrow →; if heat or a catalyst is used, it is indicated by a symbol or word, usually placed in small type above the arrow, as: $\xrightarrow{\text{delta}}$, $\xrightarrow{\text{catalyst}}$.

A reversible reaction is shown by ↔.

**chemical research.** See applied research, fundamental research.

**chemical sediment.** A sediment created by precipitation of one or more minerals from natural waters.

**chemical smoke.** Chemically generated aerosols, used primarily for military purposes. They are of four types: (1) FS, a mixture of sulfuric anhydride and chlorosulfonic acid, used in shells and bombs and sprayed from airplanes; (2) FM, titantium tetrachloride, the same as FS but brilliant white and will drop like a curtain when sprayed; (3) HC, a mixture of hexachloroethane, aluminum, and zinc oxide, burns to yield a white cloud; (4) WP, a white phosphorus, burns to form a white cloud of phosphoric acid, an excellent smoke producer.
See also fog, smoke, chemical warfare.

**chemical specialty.** A chemically formulated product manufactured from chemical components and used without further processing by household and industrial customers for specific and specialized purposes.

**chemical stoneware.** (brick, chemical).
A clay pottery product widely employed to resist acids and alkalies. It is used for utensils, pipes, stopcocks, ball mills, laboratory sinks, etc.

**chemical technology.** A general term covering a broad spectrum of physicochemical knowledge of the materials, processes, and operations used in the chemical process industries. It includes (1) basic phenomena such as activation, adsorption, oxidation, catalysis, corrosion, surface activity, polymerization, etc.; (2) the properties, behavior, and handling of industrial materials

Derivation: Synthetic product is made by fusing NaF and aluminum fluoride.
Use: Electrolyte in the reduction of alumina to aluminum; ceramics; insecticide; binder for abrasives; electric insulation; explosives; polishes.

**"Cryovac" [*Grace*].** TM for a light, shrink-film, transparent packaging material based on polyvinylidene chloride. Used especially for meats and other perishables.

**cryptands.** See cavitands.

**cryptocyanine.** (1,1'-diethyl-4,4'-carbocyanine iodide). $C_{25}H_{25}N_2I$.
Properties: Solid, mp 250–5.
Use: Organic dye, soluble, used as a chemical shutter in laser operation.
See also cyanine dye.

**cryptostegia rubber.** Rubber from leaves of *Cryptostegia grandiflora* and *C. madagascariensis*.

**cryptoxanthin.** (provitamin A; hydroxy-β-carotene). $C_{40}H_{56}O$. A carotenoid pigment with vitamin A activity.
Properties: Garnet-red prisms with metallic luster; mp 170C; soluble in chloroform, benzene, and pyridine; slightly soluble in alcohol and methanol.
Occurrence: In many plants, egg yolk, butter, blood serum. Can be made synthetically.
Use: Nutrition, medicine.

**crystal.** The normal form of the solid state of matter. Crystals have characteristic shapes and cleavage planes due to the arrangement of their atoms, ions, or molecules, which form a definite pattern called a lattice. Crystals may be face-centered, body-centered, cubic, orthorhombic, monoclinic, prismatic, etc. They have flat surfaces, sharp edges, and a definite angle between a given pair of surfaces. The form of a crystal is called its "habit." Among the most important features of a crystal are its optical properties, chief of which is its index of refraction, i.e., the extent to which a beam of light is slowed on passing through the crystal. With respect to light transmission, a crystal may be isotropic or anisotropic. Anisotropic crystals can polarize light (see also optical isomer, optical rotation). Crystals also have electrical and magnetic properties now being used in computers and other electronic devices. Crystals are almost always imperfect and contain impurities (atoms of other elements). These are utilized in semiconductors. For methods of growing crystals, see nucleation.
Single crystals are used in masers, lasers, semiconductors, miniaturized components, and computer memory systems, and as "whiskers." Many metals are now available in large single crystal form and such natural crystals as ruby, garnet, sapphire, etc., are used in these applications.
See also crystallization, nucleation, liquid crystal, hole, vacancy.

**crystal face.** The recurring characteristic surface of a crystal or a plane parallel to it.

**crystal face, indices.** Reciprocals of intercepts of a crystal plane on reference axes based on a chosen system of coordinates.

**crystal-growth step.** A ledge on the surface of a crystal, one or more lattice spacings high, where crystal growth occurs.

**crystalline rocks.** Igneous or metamorphic rock.

**crystal, liquid.** See liquid crystal.

**crystallite.** That portion of a crystal whose constituent atoms, ions, or molecules form a perfect lattice, without strains or other imperfections. Single crystals may be quite large, but crystallites are usually microscopic.
See also crystal.

**crystallization.** The phenomenon of crystal formation by nucleation and accretion. The freezing of water into ice is one of the commonest examples of crystallization in nature. Industrially, it is used as a means of purifying materials by evaporation and solidification. The sugar of commerce is made in this way. Similarly, salt cake is derived from crystallization of natural brines (e.g., Searles Lake). Nucleated crystallization is also used to form polycrystalline ceramic structures.
See also crystal.

**crystallogram.** A photograph of an x-ray diffraction pattern of a crystal.

**crystallographic systems.** (crystal systems). A categorization of crystals according to their degree of symmetry. They are cubic, hexagonal, orthorhombic, tetragonal, monoclinic, and triclinic. The cubic form has the highest symmetry.

**crystallography.** The study of the crystal formation of solids, including x-ray determination of lattice structures, crystal habit, and the shape, form, and defects of crystals. When applied to metals, this science is called metallography.

**crystals of Venus.** See copper acetate.

**crystal systems.** See crystallographic systems.

serve as an emergency food source. FDA approval is pending.

**pulp, paper.** Processed cellulosic fibers derived from hardwoods, softwoods, and other plants. There are two major types of pulp: (1) ground wood or mechanical pulp, which is merely finely divided wood without purification and is made into newsprint, cheap manila papers, and nonpermanent tissues; (2) chemical pulp, of which there are three kinds: (1) soda process pulp; obtained from the digestion of wood chips (mostly poplar) by caustic soda, (2) sulfite process pulp (mostly spruce and other coniferous woods) obtained by digestion with a solution of magnesium, ammonium, or calcium disulfite containing free sulfur dioxide; and (3) sulfate process (kraft) pulp, in which sodium sulfate is added to the caustic liquors but is reduced by the carbon present to the sulfide, which becomes a digesting agent. Sulfite and sulfate pulps (chiefly from softwoods) comprise the bulk of paper pulps. Sulfate pulps are known as kraft pulps because of their strength ("Kraft" is German for strength) and are used for wrapping, packaging, container board, etc. A relatively new process called holopulping replaces sodium sulfate with oxidants. A synthetic pulp based on polyolefins (styrene copolymer fibers) has been developed to the production stage in Japan.
See also holopulping, paper, digestion.

**pultrusion.** A technique for making certain products from glass-reinforced plastics, such as rods, electrical insulators, etc. It involves passage of continuous bundles of glass fiber that have been impregnated with liquid resin through an oven at the rate of 18 inches per minute at 140C (285F).

**pumice.** A highly porous igneous rock, usually containing 67–75% $SiO_2$ and 10–20% $Al_2O_3$, glassy texture. Potassium, sodium, and calcium are generally present. Insoluble in water, not attacked by acids.
Occurrences: U.S.A. (Arizona, Oregon, California, Hawaii, New Mexico), Italy, New Zealand, Greece.
Grade: Lump, powdered (coarse, medium, and fine); NF, technical.
Use: Concrete aggregate, heat and sound insulation, filtration, finishing glass and plastics, road construction, scouring preparations, paint fillers, absorbents, support for catalysts, dental abrasive, abherent for uncured rubber products, possible substitute for asbestos.

**Pummerer rearrangement.** Rearrangement of sulfoxides to α-acyloxythioethers in the presence acyclic anhydrides.

**pumpdown time.** The time needed to produce a certain vacuum.

**punty.** A solid or hollow iron rod 4–6 ft long, usually with an insulation covering on one end.
Use: By glass workers to remove molten material from the melt preparatory to shaping finished articles.

**"Purac" [*Henley*].** CAS: 814-80-2 TM for calcium lactate.
Use: Firming agent and nutritional supplement for fruits and vegetables.

**Purdie (Irvine-Purdie) methylation.** Exhaustive methylation of a methyl glycoside by repeated treatment with methyl iodide and silver oxide, followed by hydrolysis of the pentamethyl ether with dilute acid to yield the anomeric hydroxyl group.

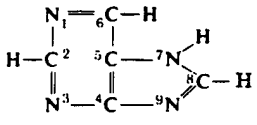
**Purex process.** See reprocessing.

**purification.** Removal of extraneous materials (impurities) from a substance or mixture by one or more separation techniques. A pure substance is one in which no impurity can be detected by any experimental procedure. Though absolute purity is impossible to attain, a number of standard procedures exist for approaching it to the extent of 1 ppm of impurity or less. The following fractionation techniques are widely used: crystallization, precipitation, distillation, adsorption (various types of chromatography), extraction, electrophoresis and thermal diffusion.
See also purity, chemical.

**"Purified Plus" [*Burdick & Jackson*].** CAS: 67-56-1 TM for purified methanol.
Use: For chromatography, pesticide, residue analysis, spectrophotometry, and semiconductor wafer processing.

**"Purifloc" [*Dow*].** TM for a polyelectrolyte.
Use: To flocculate solids in water and industrial waste treatment.

**purine.** (1) [imidazo(4,5-*d*)pyrimidine].
CAS: 120-73-0.



Properties: Colorless crystals; mp 217C; soluble in water, alcohol, toluene.
Derivation: Prepared from uric acid and re-

**"Semesan" [*Du Pont*].** TM for a wettable powder containing 25.3% hydroxymercurichlorophenol.
Hazard: As for mercury compounds.

**"Semesan Bel" [*Du Pont*].** TM for a seed disinfectant containing 12.5% hydroxymercurinitrophenol and 3.8% hydroxymercurichlorophenol.
Hazard: As for mercury compounds.

**semicarbazide hydrochloride.** (carbamylhydrazine hydrochloride; aminourea hydrochloride).
CAS: 563-41-7. $H_2NCONHNH_2HCl$.
Properties: White crystals, mp 172–175C (decomposes), soluble in water, insoluble in absolute alcohol and ether.
Derivation: From hydrazine sulfate, potassium or sodium cyanate, and sodium carbonate, or electrolytically by the reduction of nitrourea.
Grade: CP, technical.
Hazard: Toxic by ingestion.
Use: Reagent for aldehydes and ketones, isolation of hormones and isolation of certain fractions from essential oils.

**semi-conductor.** An element or compound having an electrical conductivity intermediate between that of conductors and non-conductors (insulators). Most metals have quite high conductivity, while substances like diamond and mica have very low conductivity (high resistance). Between these extremes lie the semi-conductors, of which germanium, silicon, silicon carbide, and selenium are examples, with resistivities in the range of $10^{-2}$ to $10^{9}$ ohms/cm. Slight traces of impurities in the crystalline structure are essential for semi-conduction; arsenic is a typical impurity in semi-conductor crystals. These impurities function as electron donors or acceptors, and the semiconductor is designated n-type or p-type, depending on the electrical nature of the "holes" or energy deficits in the crystalline lattice.

The functioning of semi-conductors involves the science of solid-state physics. Their discovery in the early 1940s made possible the development of transistors, with their manifold applications in electronic devices, in which they have largely replaced the vacuum tube.

There are a few organic semi-conducting compounds which contain a significant amount of carbon-carbon bonding and are also capable of supporting electronic conduction. Anthracene and Ziegler-catalyzed acetylene polymers (conjugated polyolefins) are examples.
See also crystals, impurity, solid, solid-state chemistry.

**semimicrochemistry.** Any chemical method (usually analytical) in which the weight of the sample used is from 10 to 100 mg.

**semipermeable membrane.** See membrane, semipermeable.

**semisynthetic.** A term often used to describe end-products that are manufactured from natural materials but do not occur in the free state, e.g., paper, glass, soap, cement, rayon, leather, etc.

**Semmler-Wolff reaction.** Rearrangement of $\alpha,\beta$-unsaturated cyclohexenyl ketoximes into aromatic amines under acidic conditions.

**"Sentry" [*Union Carbide*].** TM for sorbic acid and potassium sorbate.
Use: Fungistats for the control of certain molds and yeast in foods. Also TM for propylene glycol, USP. Solvent for flavors and colors; humectant for baked goods, and plasticizer for cork seals and crowns.

**"Separan" [*Dow*].** TM for a series of flocculating agents.
AP30. Synthetic, high-molecular-weight, anionic polymer.
C-90 and C-120. Synthetic, high-molecular-weight, cationic polymers.
MGL. Similar to NP10. Used in production of uranium.
NP10. Synthetic, water-soluble, nonionic, high-molecular-weight polymer of acrylamide. "Separan" NP 10 potable water grade flocculant has been accepted, subject to maximum use concentration of 1 ppm, by the U.S. Public Health Service.
NP20 Nonionic polyacrylamide polymer.
PG2 Similar to NP10. Used in paper manufacture.

**separation.** A collective term including a large number of unit operations that, in one way or another, isolate the various components of a mixture. Chief among these are evaporation, distillation, drying, gas absorption, sedimentation, solvent extraction, press extraction, adsorption, and filtration. Specialized methods include centrifugation, electromagnetic separation (mass spectrograph), gaseous diffusion, and various types of chromatography.
See specific entry for further information.

**"Sephadex."** TM for a dry insoluble powder composed of microscopic beads that are synthetic, organic compounds derived from the polysaccharide dextran. The dextran chains are crosslinked to give a three-dimensional network, and the functional ionic groups are attached to the glucose units of the polysaccharide chains by

dioxide. The latter is dissolved in water containing the ammonia and salt, with resultant precipitation of sodium bicarbonate. This is separated by filtration, dried, and heated to form normal sodium carbonate. The liquor from the bicarbonate filtration is heated and treated with lime to regenerate the ammonia. Calcium chloride is a major by-product.

*Note*: Because this process requires much energy and pollutes streams and rivers with chloride effluent many plants using it have closed, production being obtained from the natural deposits in the western U.S.

**"Solvenol" [*Aqualon*].** TM for a group of monocyclic terpene hydrocarbons with minor amounts of terpene alcohols and ketones.
Use: General solvent, rubber reclaiming.

**solvent.** A substance capable of dissolving another substance (solute) to form a uniformly dispersed mixture (solution) at the molecular- or ionic-size level. Solvents are either polar (high dielectric constant) or non-polar (low dielectric constant). Water, the most common of all solvents, is strongly polar (dielectric constant 81), but hydrocarbon solvents are non-polar. Aromatic hydrocarbons have higher solvent power than aliphatics (alcohols). Other organic solvent groups are esters, ethers, ketones, amines, and nitrated and chlorinated hydrocarbons.

The chief uses of organic solvents are in the coatings field (paints, varnishes and lacquers), industrial cleaners, printing inks, extractive processes, and pharmaceuticals. Because many solvents are flammable and toxic to varying degrees, they contribute to air pollution and fire hazards. For this reason, their use in coatings and cleaners has declined in recent years.
See individual compounds.

**solvent, aprotic.** A solvent that cannot act as a proton acceptor or donor, i.e., as an acid or base.

**solvent drying.** Removal of water from metal surfaces by means of a solvent that displaces it preferentially, as on precision equipment, electronic components, etc. Examples of solvents used are acetone, 1,1,2-trichloro-1,2,2-trifluorethane, 1,1,1-trichloroethane.

**solvent dye.** See dye, solvent.

**solvent extraction.** A separation operation that may involve three types of mixture: (1) a mixture composed of two or more solids, such as a metallic ore; (2) a mixture composed of a solid and a liquid; (3) a mixture of two or more liquids. One or more components of such a mixture are removed (extracted) by exposing the mixture to the action of a solvent in which the component to be removed is soluble. If the mixture consists of two or more solids, extraction is performed by percolation of an appropriate solvent through it. This procedure is also called leaching, especially if the solvent is water; coffee making is an example. Synthetic fuels can be made from coal by extraction with a coal-derived solvent followed by hydrogenation.

In liquid-liquid extraction, one or more components are removed from a liquid mixture by intimate contact with a second liquid, which is itself nearly insoluble in the first liquid and dissolves the impurities and not the substance that is to be purified. In other cases, the second liquid may dissolve, i.e., extract from the first liquid, the component that is to be purified, and leave associated impurities in the first liquid. Liquid-liquid extraction may be carried out by simply mixing the two liquids with agitation and then allowing them to separate by standing. It is often economical to use countercurrent extraction, in which the two immiscible liquids are caused to flow past or through one another in opposite directions. Thus, fine droplets of heavier liquid can be caused to pass downward through the lighter liquid in a vertical tube or tower.

The solvents used vary with the nature of the products involved. Widely used are water, hexane, acetone, isopropyl alcohol, furfural, xylene, liquid sulfur dioxide, and tributyl phosphate. Solvent extraction is an important method of both producing and purifying such products as lubricating and vegetable oils, pharmaceuticals, and nonferrous metals.

**solvent, latent.** (co-solvent). An organic liquid that will dissolve nitrocellulose in combination with an active solvent. Latent solvents are usually alcohols and are used widely in nitrocellulose lacquers in a ratio of 1 part alcohol to 2 parts active solvent.

**solvent naphtha.** See naphtha (2b).

**Solvent Red 73.** See 4′,5′-diiodofluorescein.

**solvent refining.** See solvent extraction.

**Solvent Yellow 3.** See o-aminoazotoluene.

**solvolysis.** A reaction involving substances in solvent, in which the solvent reacts with the dissolved substance (solute) to form a new substance. Intermediate compounds are usually formed in this process.
See also hydrolysis.

**soman.** (methylphosphonofluoridic acid-1,2,2-trimethylpropylester). CAS: 96-64-0.

## RELATED PROCEEDINGS APPENDIX

NONE

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